U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-260 132

MILK AND FOOD PROBLEMS IN CIVIL DEFENSE

ROBERT A. TAFT SANITARY ENGINEERING CENTER
CINCINNATI, OHIO

1 JUNE 1956

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Public Health Civil Defense Training

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(Revision Copy - 6/1/56)

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U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

BIBLIOGRAPHIC DATA SHEET	1. Report No.	2.	3. Recipient's Accession No. PB-260 132
4. Title and Subtitle Milk and Food Problems in Civil Defense			5. Report Date 1 Jun 56 6.
7. Author(s) Milton J. Foster, Harol L. Jeter, and Keith H. Lewis.			8. Performing Organization Rept. No.
9. Performing Organization Name and Address Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.			10. Project/Task/Work Unit No. 11. Contract/Grant No.
12. Sponsoring Organization Name and Address			13. Type of Report & Period Covered 14.

15. Supplementary Notes
Portions of this document are not fully legible.

16. Abstracts
In the event of a national emergency, with subsequent attack on the major population and industrial centers, it would be necessary that U. s. food sources be protected, conserved, and provided for safe human consumption. Previous to or following an attack, sabotage of milk, other foods and water supplies by biological agents might occur. The safety of food at its source, in transit, and in its preparation and serving would be the responsibility of the appropriate health department personnel. Various contingency plans are reviewed.

17. Key Words and Document Analysis. 17a. Descriptors

17b. Identifiers/Open-Ended Terms

*Food processing
*Dairy products
Food industry
*Emergency planning
Water supply
Water quality
*Radiation hazards
Toxic hazards
Strategy
Public health
Fallout

17c. COSATI Field/Group 6H

18. Availability Statement	19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages 37
	20. Security Class (This Page UNCLASSIFIED	22. Price

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MILK AND FOOD PROBLEMS IN CIVIL DEFENSE

I. Introduction

In the event of a national emergency, with subsequent attack on our major population and industrial centers, it will be necessary that food resources be protected, conserved and provided for safe human consumption. Following an attack with nuclear weapons, accompanied by the use of biological and toxic chemical agents, the resulting situation would, in many respects, resemble peacetime disasters except that the disaster would differ in degree and duration and be complicated by the problems associated with mass evacuation and feeding of the large displaced civilian population. Protected and unprotected foods in retail markets, delicatessens, eating and drinking establishments, catering facilities, home stocks and reserve supplies in warehouses will be buried in wrecked buildings, damaged by blast and fire and flooded with polluted water and sewage from a wrecked sewerage system. In addition, problems resulting from contamination by radioactive fallout, chemical and biological warfare agents will further complicate the disaster. In rural areas outside the zones of total destruction and serious damage, milk producing animals, other food producing livestock, grains in barns and food crops in the fields may become contaminated from the use of any of the special offensive weapons (Slides).

Previous to or following an attack, sabotage of milk, other foods and water supplies by biological agents and toxic chemical agents may occur. Targets will be the foods for vital industrial workers, military and governmental installations, mass evacuation centers, hospitals and

other critical centers. Although the sabotage attacks may not result in high personnel fatalities, an adverse psychological effect will have been achieved.

Under extreme conditions, it may be necessary to live primitively "off the land" using raw fruits and vegetables, milk from nearby farms, slaughtered beef, sheep, hogs and fowl and any remaining grain stocks. With the repair of roads and other means of transportation, safe foods from unaffected areas will have to be protected during transportation, distribution, and use in contaminated areas.

The safety of food at its source, in transit and in its preparation and serving will be the responsibility of the appropriate health department personnel.

II. Nuclear Weapons and Food Supplies

A. General

In an attack with nuclear weapons damage to food supplies and food processing facilities through effects of blast and heat will be limited to the general area of the bomb burst. Most descriptions of blast and heat effects of nuclear weapons define areas of damage roughly in terms of a series of zones ranging from; (1) a zone of total destruction; (2) a zone of severe damage; (3) a zone of moderate damage and (4) zone of light to no damage. The extent of the damaged zones will vary according to the power of the weapon, its proximity to the earth at the time of detonation, and to some extent on the topography of the target area.

Foods in the immediate vicinity, if not destroyed outright by blast and heat, would become temporarily radioactive because of

neutron bombardment from the fireball. The 1955 tests at the Nevada Proving Grounds with small weapons have demonstrated that food in glass or metal containers within 1/4 mile of the bomb burst became intensely radioactive but could be used several days after the blast. Dairy products became radioactive, probably due to their calcium content. The half life of calcium is much longer than that of sodium or potassium which would delay their useability. Furthermore, this element is stored in the body. Sea foods also became radioactive. Glass food containers were particularly affected probably due to the formation of radioactive sodium.

Over great areas, foodstuffs, just as other materials in the environment, will be subjected to the fallout of radioactive materials originating directly or indirectly from a nuclear weapon. Based upon data reported from the March 1954 Pacific Tests, thousands of square miles of rural area could be dangerously contaminated by fallout. Domestic animals and man are equally sensitive to the effects or radiation but livestock, if on pasture during the fallout, would be more vulnerable to fallout effects and unless remedial measures are taken during the emergency period, vast quantities of animals and animal food products might be lost. Preventive measures to avoid ingestion of foodstuffs contaminated with radioactive material therefore assume importance from a public health viewpoint.

B. General Courses of Action

Monitoring will identify areas free from radioactive fallout. Uncontaminated food and milk in these areas will receive early clearance for consumption. Serious problems may arise in areas showing presence of appreciable fallout material. Questions regarding the freedom of specific foodstuffs from radioactive contamination will arise on every hand. Within the limits of monitoring facilities, arbitrary maximum levels of radioactivity of food and water will have to be used as a basis for determining their fitness for human consumption. Such a suggested scale of radioactive limits is presented in Table 1. (Slide)

Table 1

SUGGESTED EMERGENCY LEVLES FOR FOOD AND WATER IMMEDIATELY FOLLOWING A NUCLEAR EXPLOSION(1)

Consumption Period	Beta Activity Levels Microcuries per cc
Preferable Risk	
10 days	3.5×10^{-3}
30 days	1.1×10^{-3}
Acceptable Risk	
10 days	9×10^{-2}
30 days	3×10^{-2}

It is emphasized that these are not peacetime permissible levels of radioactivity for either short or long term consumption. Responsible officials can utilize these values during periods of emergency with the conviction that water and foods with radioactivity falling below these limits can be used with no real hazard. The beta-gamma values do not apply for periods later than one month after a nuclear explosion, since the longer lived radioactivity remaining carries an increasing hazard for human consumption.

It can be anticipated that monitoring services will be completely inadequate for direct evaluation of all food and milk originating within a fallout area the first few days after an attack. Much thought is being given to this difficulty. An approach to this problem is emerging in which reliance is placed on the findings of area monitoring as a basis for deciding whether milk and other foods may be consumed immediately or if temporary or permanent embargo must be placed on their use. Using such an approach, if the area monitors find lower radioactivity levels than some maximum figure in roentgens per hour "x" hours after the bomb burst, then food originating within that area would be arbitrarily considered acceptable for human consumption. If, on the other hand, area monitoring shows higher radioactivity levels than the selected maximum tolerance level, then temporary or permanent embargo would be placed on use of foods originating within the area. These decisions will, undoubtedly, be based on approximations which, at best, will apply to the majority of the animals or food products

in any iso-intensity area. Area monitoring information not only would define the hazardous areas but it also would delineate the relatively safe areas which would probably constitute the majority of the nation's rural land and thus prevent unnecessary restrictive measures and loss in food production due to the lack of guide-lines.

C. Fallout Effects on Livestock and Animal Products

The effects of fallout on livestock and animal food products has been evaluated by Wolff[2]. He indicates that locales affected by fallout could be placed in one of four designated areas depending on the reported levels of gamma intensity in the area corrected to H + 7 hours at three feet from the ground. The values for H + 7 hours were extrapolated from fallout level approximations 3.5 hours after the blast. These area classifications are: Area I - less than 6r/hr; Area II - 6-12r/hr; Area III - 13-30r/hr; and Area IV - greater than 30r/hr.

With a serious contaminating fallout, external and internal radiation hazards would exist simultaneously. During the first 24 to 72 hours following the fallout the external radiation will be the major concern. If there is sufficient warning time before the fallout begins, animals should be sheltered wherever feasible. After the fallout begins, protection of livestock should be ignored until monitoring data defines the human risk.

Based on approximations, Table 2 (Slide) indicates the probability of illness and death expected among unprotected livestock in areas of a given radiation intensity. The gamma radiation

would contribute primarily to any resultant radiation illness and death due to its penetrating whole body exposure. The beta radiation, because of its limited penetrability, would contribute to the total radiation exposure by producing beta burns on skin areas to which fallout has adhered. Internal radiation is the result of ingesting contaminated feed.

Table 2

Probable Radiation Effects of Fallout On Pastured Livestock as Related to the Level of Gamma Intensity in the Area(1)

Gamma Intensity		Probable Radiation Effects			Recommended Disposition
Intensity* (r/hr)	Area	Illness	Deaths	Survival Time (Days)	
Less than 6	I	Not probable	0	--	"normal area"
6 to 12	II	Probable	Not probable	20 - 50	Option of farmer
13 to 30	III	Probable	50%	10 - 40	Market during latent period
Greater than 30	IV	Certain	100%	3 - 20	Market during latent period

(1) Wolff, A.R., Veterinarian, Occupational Health Program, Div. Special Health Services, PHS (Private communication).

* 7 hours after the explosion and 3 feet off ground

Table 3 (Slide) summarizes the radiation effects for sheltered livestock. Many of the animals recommended for slaughter because of their area location may appear healthy for many days. This is characteristic of the radiation syndrome. The marketing of the animals should be done during this symptom-free period excluding the obviously ill or moribund animals.

Table 3

Probable Radiation Effects of Fallout for Sheltered Livestock as Related to the Level of Gamma Intensity in the Area(1)

Gamma Intensity		Probable External Effects			Recommended Disposition
Intensity* (r/hr)	Area	Illness	Death	Survival Time (Days)	
Less than 12	I & II	Not probable	0	--	Option of farmer
13 - 30	III	Probable	Not probable	20 - 50	Option of farmer
Greater than 30	IV	Probable	50 - 100%	3 - 30	Market during latent period where feasible

(1) Wolff, A.R., Veterinarian, Occupational Health Program, Div. Special Health Services, PHS (Private communication).

* 7 hours after the explosion and 3 feet off ground

D. Marketing Animal Food Products During Emergency Period

Livestock survival is primarily affected by external radiation but after the first 2 to 3 days following the fallout, the hazards resulting from internal radiation will become important. The internal hazards to the animal per se is not the critical factor but rather the potential internal hazard to man resulting from ingestion of food products from livestock pastured in heavy fallout areas. Table 4 (Slide) indicates approximate levels of pasture contamination and their relation to the potential human hazard from the ingestion of animal food products derived from these pasture areas during the emergency period.

Table 4

Marketability of Animal Food Products Derived from Pastures in Fallout Areas During Emergency Period as Related to Area Level of Gamma Intensity(4)

Gamma Intensity Fallout Zone		Food Products		
Intensity (r/hr)	Area	Bottled Milk	Manufactured Dairy Products(1)	Meat Poultry, etc.
Less than 6	I	No(2)	Safe	Safe
6 - 12	II	No	No	Safe(3)
13 - 30	III	No	No	Suspect(3)
Greater than 30	IV	No	No	Suspect(3)

(1) A minimum of 30 days should elapse between processing and marketing.

(2) Bottled or packaged milk should come from a milk shed with an intensity of less than 0.3r/hr during the emergency period.

(3) Should be processed carefully to avoid contamination of edible parts from skin and gut, and preferable slaughtered separately. Skins, thyroids, blood and gastrointestinal tract should be condemned for any usage including rendering.

(4) Wolff, A.R., Veterinarian, Occupational Health Program, Div. Special Health Services, PHS (Private communication).

The restrictions recommended for the marketing of food products derived from animals on contaminated pastures would not apply to the products derived from stabled animals in the same areas provided they were receiving feeds with minimal fallout contamination. Most stored feeds, such as baled hay, silage, and grain, should be assumed safe for livestock feed. Even haystacks in fallout areas would be usable except in the heaviest fallout area, i.e., Area IV, where the surface layers of the stack should be stripped off prior to using as feedstuff.

Dairy cows, unfortunately, have the ability to concentrate various radioactive fission products in the milk following ingestion of contaminated feed. This fact plus the dietary importance of milk to infants and children and their greater susceptibility to radiation effects result in milk being the most critical animal food product.

Milk for manufacturing purposes should originate in a milk shed, if grazing is practiced, within the confines of Area I, that is less than 6r/hr. Under these conditions at least 30 days should elapse before the manufactured dairy product is marketed, thus permitting decay of the shorter lived radioactive substance in the milk.

In the case of fresh bottled milk, even Area I may not be a safe milk shed and it is recommended that milk intended for the bottle or package market, originate in a milk shed, if grazing is practiced, where the H + 7 intensity is less than 0.3r/hr.

Meat animals, including poultry, would not metabolize fission products into the edible carcass parts in nearly the concentration that occurs with milk. It can be assumed that during the emergency period all food products derived from grazing animals in Areas I and II would be safe for human consumption. Those products from Areas III and IV will contain varying amounts of metabolized contamination and should be considered suspect and held in storage for a post-emergency radiological evaluation. The skins and gastrointestinal tracts of animals from Areas II, III, and IV will be contaminated with fission products and care should be exercised

to prevent contamination of the edible parts from the contaminated skin and intestinal tracts. If feasible, animals from Areas II, III, and IV should be hosed down prior to slaughter and preferably slaughtered separately.

The above approximations and courses of action are proposed by Wolff as tentative guidelines and apply to the problems which might arise during the 15 day post detonation period. As early as possible after the emergency period, more accurate methods and controls should be utilized and all livestock grazing should be confined to pasture areas, the intensity of which does not exceed that originally defined as Area I.

E. Decontamination and Restoration of Food Supplies

If food is scarce, civil defense activity will include decontamination, salvage, and restoration of food supplies and facilities for preparing and serving food. Initial activities undoubtedly will occur in the least damaged areas. Salvage and decontamination work will proceed toward the area of total destruction, continuing until such a point of destruction is reached that further salvage and decontamination offers little to no return. Obviously, the working area and exposure time for working parties will be defined by instructions from the appropriate Civil Defense authorities.

Many foods will be available for immediate use, even within areas having dangerous radioactivity levels. These foods will be usable because of the protection from radioactive fallout afforded by packaging materials. Sealed foods, in metal or glass containers

and in heavy cardboard, wood or plastic boxes should be free of or low in radioactivity. Even unsealed foods in closed refrigerators or other tightly sealed rooms may receive a considerable amount of protection from fallout contamination. Foods within packages or in storage chambers such as refrigerators, cold rooms and the like may become dangerously contaminated in being removed unless the package covering or premises are first thoroughly decontaminated. Suggested decontamination procedures are indicated in Table 5. It must be remembered that radiological decontamination is <u>not</u> a chemical reaction in which some neutralizing substance is added, with destruction of radioactivity. Decontamination is only a cleaning operation in which radioactive material is removed from places where it is or will be dangerous to places where it will be less dangerous. Cleaning may be accomplished by trimming outside layers of the food, with water, steam, detergents, complexing agents, organic solvents, acid mixtures, caustics, abrasion, flame equipment, vacuum cleaning, and the like. The choice of the decontaminating agent and method will be determined by the nature of the surface to be decontaminated and by the availability of materials and equipment. Dangerous waste solutions should be buried in an unoccupied area which is appropriately identified.

Thus the total supply of food and milk will not be destroyed or made otherwise useless in an area affected by nuclear weapons. The education of the public in the principles involved, and application of even simple protective and decontamination measures will result in a great reduction in the danger of widespread sickness and death due to consumption of foods contaminated with radioactive material.

Table 5
Salvage of Typical Foods(3)

Kind of food of package	Possible salvage procedure in case of -		
	Contamination with radioactivity	Blast and fire damage	Water damage (pollution)
Perishable: Fresh fruits & vegetables, fish, poultry	Remove outside portions of lot containing most radioactivity. If remaining contamination is less than emergency tolerance, release interior portions. Washing of fruits & vegetables may be of value.	Look for contamination with poisons. If pathogens are present sterilize before using.	Wash to remove surface contamination. Cook to kill bacteria.
Non-perishable: Dried fruits & vegetables, flour & grains, bulk sugar stocks.	Remove outside portions of lot containing most radioactivity. If remaining contamination is less than emergency tolerance, release interior portions. Washing of fruits and vegetables is not feasible.	Look for contamination with poisons. If pathogens are present sterilize before using.	Prompt sterilization & use of fruits and vegetables. Remove flour and grain which is not caked. Cook before using. Re-refine sugar
Cardboard and paper containers	Remove outside portions of lot containing most radioactivity. If remaining contamination is less than emergency tolerance, release interior portions. Remove dust by brushing. Remove outer wrappers.	Look for contamination with poisons. If pathogens are present sterilize before using.	If salvage attempted, sterilize food from water-damaged containers before it is consumed
Canned goods: Hermetically sealed cans.	Wash outside of container with detergent, or remove radioactivity by brushing. Interior portions of stacks may be relatively free of radioactivity.	Look for & destroy cans with ruptured seams or closures. Remove abnormal cans. Look for spoilage from thermophilic organisms.	Sterilize surfaces of cans. Watch for pinholing of metal. Use damaged stocks promptly.
Containers with screw caps, friction type lids, etc.	Wash outside of container with detergent, or remove radioactivity by brushing. Interior portions of stacks may be relatively free of radioactivity. Test contents before releasing for use.	Look for & destroy cans with ruptured seams or closures. Remove abnormal cans. Look for spoilage from thermophilic organisms.	Difficult to remove contamination from beneath or around closure. Sterilize foods before using.

III. Contamination of Foods With Chemical Warfare Agents

A. General

The contamination of foodstuffs by chemical warfare agents will create certain health hazards to the population and complicate salvage and decontamination problems. Food producing livestock, field crops, protected and unprotected foods and supplies may become contaminated by exposure to the vapor, aerosol sprays, liquid splashes of chemical warfare agents. The most dangerous agents are the nerve gases. The uninformed population and persons recruited for civil defense work following an attack may become poisoned by inhalation, contact or ingestion of the toxic chemicals. The use of toxic chemicals in sabotaging food supplies before an overt attack, in mass feeding centers following an attack and in critical industrial centers may be emphasized and must be guarded against.

B. General Course of Action

If an attack with a chemical warfare agent or sabotage is suspected, all livestock, crops and foodstuffs in the area should be temporarily embargoed. Contaminated foodstuffs should be handled only by those trained in the detection and decontamination methods and equipped with proper protective masks and clothing. The courses of action to be taken will be based on results of the information obtained by trained personnel who have available CW test kits for field use. Whether salvage should be undertaken will depend on the type and extent of contamination, availability of replacement

supplies and means of decontamination. With nerve gas, evaporation and dispersion may be slow and areas may remain contaminated for extremely long periods of time.

C. Use of Milk, Livestock and Field Crops Exposed to CW Contamination

Until transportation routes can be repaired and food supplies replenished, it may be necessary to utilize the milk, livestock and crops in the contaminated area in mass feeding. In general the effect of chemical warfare agents on man and animals is similar and it may be necessary to slaughter the animals immediately and use all edible parts of the carcasses. After slaughtering, all affected parts should be trimmed and the discarded parts buried. The use of CW test kits will help reduce the hazards of using foods under these conditions.

D. Contamination of Foodstuffs by Chemical Warfare Agents

The liquid nerve and mustard gases are the most dangerous to foods since both of these gases are soluble in fats and oils. Slow diffusion of the gas through the unprotected food may occur after contamination. Foods with high water content, potentiate the breakdown or hydrolysis of some gases to products not highly toxic but which impart off-flavors. In general, foods of low water and low fat content are not easily contaminated.

Foods stored in home and walk-in refrigerators and deepfreeze cabinets will be afforded various degrees of protection. Unprotected foods should not be eaten until the type and extent of contamination is determined. If possible they should be set aside

for airing for 24 to 48 hours and retested.

Extensive studies have been conducted on gas permeation and the protection afforded by a variety of packaging materials using mustard gas. The results obtained using mustard gas are equally applicable to the nerve gases. The results are shown in Table 6.

Table 6

Protective Value of Various Types of Food Containers Against Mustard Gas Contamination(4)

Type of Container	Type of Gas Contamination	
	Vapor	Liquid
Glass (sealed)	Complete	Complete
Cans (sealed)	Complete	Complete
Wooden barrels	Complete	Good
Fiberboard	Complete	Fair
Waxed Cardboard	Good	Poor
Plain Cardboard	Poor	None
Greaseproof paper	Good	Poor
Sacks, canvas	Poor	None
Cellophane	Good	Poor
Multilayer bags	Good	Poor
Metal foils	Complete	Good
Wrapping papers	Poor	None

E. Decontamination Procedures

Until the type, extent and area of contamination have been determined, no foodstuffs should be used. Decontamination of food containers heavily contaminated with the toxic gases is dangerous. Unless food is scarce or large amounts are involved, the foods should be buried or burned in an uninhabited area.

Practical decontamination procedures for use under field or emergency conditions are:

1. Airing the foods for 24 to 48 hours.
2. Washing with water, dilute alkali (2% solution of sodium bicarbonate), 2% soda ash solution or bleach slurry.
3. Peeling and discarding the outer contaminated layers of the food.
4. Cooking the food (boiling water containing 2% sodium bicarbonate) for 1 to 2 hours.

IV. Problems Resulting from the Use of Biological Warfare Agents and Deterioration of Sanitation Measures

A. Vulnerability

The reported incidence of foodborne disease in the U. S. under normal conditions during the 17-year period from 1938 through 1954 was approximately 4,700 outbreaks involving about 177,000 cases and resulting in 600 deaths. At best, no more than 10 to 25% of the true number of outbreaks were reported. These statistics will be magnified greatly with the use of biological agents overtly or in sabotage attacks, the contamination of foodstuffs with polluted water and sewage following the blast and fire of a nuclear weapon, and the deterioration of food sanitation safeguards attending mass evacuation or bombing disasters.

Biological warfare agents have distinct advantages for covert or sabotage attack of foodstuffs; namely, (1) delayed action, (2) small quantity needed and (3) the difficulty of detection. These advantages, plus the fact that milk and other foods are ideal media for the survival of microorganisms, make this mode of attack particularly attractive to the saboteur. Enemy agents having access

to eating and drinking establishments, mass feeding centers, food processing establishments, or storage facilities, could readily introduce pathogens, toxins or heat-resistant spoilage microorganisms into foods. Milk supplies are vulnerable to covert attack by contamination of the milk supply on the farm, in transit and particularly in the dairy plants. Biological agents and toxins not destroyed by pasteurization, e.g. bacterial spores or staphylococcal enterotoxin, would be agents of choice. The syrups of a number of our popular soda fountain beverages are produced in bulk at plants and shipped over the nation to be dispensed without being subjected to a sterilizing treatment. Flour, cake mixes, breakfast foods, and other prepared cereals could likewise be easily sabotaged with biological agents which would persist in this environment. These are but a few instances of possible routes by which a saboteur could contaminate our food supply.

Incidental contamination of unprotected foodstuffs could occur during attack in which large clouds of pathogenic aerosols were released over a target area. In many ways the problems arising from such aerosol contamination are comparable to those associated with "fallout" of radioactive materials.

B. Foodborne Disease and Intoxications

By way of review, a number of diseases, which have been transmitted through milk or other foods in the past, may present serious problems under emergency conditions because of lowered sanitary safeguards. Among these are:

1. Food poisoning or intoxication

    a. Botulism (Types A, B, and E)
    b. Staphylococcal food poisoning
    c. Paralytic shellfish poison

2. Milk and foodborne infections

    a. Septic sore throat
    b. Poliomyelitis
    c. Q. Fever
    d. Tuberculosis
    e. Undulant fever
    f. Tularemia
    g. Typhoid fever
    h. Scarlet fever
    i. Diptheria
    j. Cholera
    k. Trichinosis
    l. Bacillary Dysentery
    m. Amoebic Dysentery
    n. Anthrax
    o. Salmonellosis
    p. Ornithosis

3. Food poisoning due to metals and chemicals

    a. Zinc poisoning due to storage of lemonade in galvanized iron pails

    b. Cadmium poisoning due to acid liquids in cadmium coated canteens and trays.

C. Rapid Detection of BW Agents in Foods

Following an attack in which contamination of food by BW agents seems probable, as indicated by presumptive evidence of sabotage or dispersal of an aerosol, all suspected foodstuffs should be temporarily embargoed until the kind, amount, and extent of contamination can be assessed. Unless there is an extreme shortage, it would be best to burn or bury all lots of foods found to be contaminated.

There is need for the development of more practical and rapid methods for the detection of biological warfare agents in or on foods and on food equipment surfaces.

D. Food Protection

Commercial canning procedures, in which heat processed foods are hermetically sealed in impervious containers, will protect the food from external contamination and subsequent spoilage. Although the outside of the container may become contaminated, the food inside should be protected, providing the package seams are not ruptured and no "pin holes" or channels have developed. The degree of protection afforded foods will vary with the packaging material and type of package. Until proven otherwise by laboratory and field tests, it must be assumed that all packaged foods exposed to BW contamination will have to be decontaminated before opening for use. Foods packaged in paper, cloth and hemp bags, in baskets, slat crates, barrels, cardboard cartons, wax paper and plastic wrappers appear most vulnerable to contamination. Information on the adequacy of the closures and impermeability of the many types of containers and packages is not sufficient to assess their protective capacity. (Slide)

The degree of protection afforded foods in home and walk-in refrigerators and deepfreeze cabinets, trucks, refrigerator and tank cars, is not certain. As with radioactive fallout, foods should be protected from contamination by removing them from cold storage or other enclosed spaces.

Storage of perishable food supplies under emergency conditions is a facet of food protection which requires attention. Refrigeration in various plants outside the zones of total or serious damage may be usable. In other cases, we may have to resort to the "cold cellar", brine preservation of foods, placing the food in containers and placing them under a wet cover, use of railroad refrigerator cars, and other old-fashioned methods. Improvising and ingenuity under disaster conditions will be required. (Slide)

In the absence of suitable processing and storage facilities, or other normal sanitation safeguards, consideration may be given to the emergency use of antibacterial agents, such as hydrogen peroxide and antibiotics, as milk and food additives to minimize spoilage and limit occurrence of foodborne disease outbreaks.

A safe water supply for cooking, dishwashing and general sanitation will be of utmost importance. Waters and ice of unknown quality should not be used by the operating eating establishments and welfare organizations.

Attention must also be given to the protection of food supplies to prevent insect and rodent infestation or scavenging by animals.

E. Decontamination of Food Containers and Equipment

Salvage operations should be supervised by personnel with a knowledge of the physical and chemical properties of the decontaminating materials and methods to be used. Smooth, clean surfaces are more readily decontaminated than are soiled or porous surfaces. Although it is possible to disinfect the surface of a soft drink

bottle or glass canning jar, it is almost impossible to decontaminate the surface under the cap or jar lid and prevent contamination on opening the container. It has been suggested that food containers be opened in an area covered by the label. (Slides)

The following decontamination procedures and agents are suggested:

1. Heat

   a. Cooking foods at the boiling temperature for at least 1 hour or more.

   b. Steam under pressure, 250°F for 20 minutes or more.

   c. Dry heat oven, 270° F for 2 hours or more.

2. Chemical Disinfectant Solutions (Table 7)

   a. 5% solution of hydrochloric or sulphuric acid.
   b. 5% solution of sodium hydroxide.
   c. Household lye (98% NaOH).
   d. Chlorine solutions, such as household bleach preparations or chloride of lime.
   e. Certain iodine and bromine preparations.

3. Chemical Gaseous Disinfection

   a. Formaldehyde at temperatures above 40°C and elevated humidity.
   b. Ethylene oxide - carbon dioxide gas mixture.

4. Physical Decontamination (Table 8)

   a. Scrubbing with soap and detergent-sanitizer solutions.
   b. Dry rag or paper wiping.
   c. Placing fresh paint, glue or plastic film on a surface.
   d. Scrubbing with sand or abrasive material.

5. The persistence of biological agents varies with the kind of organism and the environmental conditions. The effects of sunlight, oxidation, moisture, temperature and dilution all serve to

TABLE 7

The sporocidal efficiencies of emergency disinfectants against dried films of Bacillus globigii* spores on clean glass surfaces

Decontamination Method	ppm	pH	Per Cent Reduction — Exposure Time: 2 minutes	10 minutes	30 minutes	60 minutes
Apple Cider Vinegar Undiluted 5% Acetic Acid	-	3.5		5.9		6.0
Household Ammonia Solution Undiluted 4% NH_4OH	-	12.0		0.6		1.0
Chlorine Bleach 3 tablespoons per gal. H_2O	500	11.3		45.6	61.6	89.3
Chlorine Bleach + Vinegar 3 tablespoons bleach + 1.5 tablespoons vinegar per gal. H_2O	460	7.6	100.0	100.0		
Lysol Active ingred:Soap,Orthohydroxydiphenyl,Alcohol-Cresylic Acid 2.5 tablespoons per gal.H_2O	-	9.2		29.6	31.3	36.6
USP XIV Iodine Tincture (2.0% I_2, 2.4% KI in 47% C_2H_5OH) 1.33 tablespoons per gal H_2O	88	7.4	98.9	100.0		
Globaline Tablets (Tetraglycine Hydroperiodide) 4 tablets per gal H_2O	7.6	6.2		98.7	99.7	100.0
Halazone Tablets (p-N-N-Dichlorosulfamidebenzoic Acid) 8 tablets per gal H_2O	3.96	7.8		4.9	4.7	4.3

*Inoculum consisted of 5 to 10 million spores per square inch

Table 8

The effect of various cleansing methods in removing dried films of *Bacillus globigii** spores from glass surfaces

Decontamination Method	Percent Reduction in Spores
Under running tap water for 5 minutes	49.5
Damp rag; 100 strokes	93.6
Toilet paper; 100 strokes	99.1
Dry rag; 100 strokes	99.3
Dry brush; 100 strokes	99.5
Wet brush; 100 strokes	99.9
Detergent & water; 100 brush strokes	99.9
Spic and Span & Water; 100 brush strokes	99.9
Babo and Water; 100 brush strokes	99.9
Brillo pad and Water; 100 strokes	99.9

* Inoculum consisted of 5 to 7 million spores per square inch

decrease the number of viable microorganisms. If conditions permit, aging and weathering will reduce greatly surface microbial contamination in a few days.

6. Foods contaminated with BW agents should be buried under supervision to avoid the spread of the agents and reinfection of the surviving population. (Slides)

V. Vulnerability of foods to Overt and Covert Attack

At the request of the Food and Drug Administration, the National Academy of Sciences - National Research Council, established a Civil Defense Foods Advisory Committee to study the vulnerability of the major food processing and warehousing industries to overt and covert special weapons attack. This committee was composed of recognized leaders in food manufacturing and research and their report was submitted in November, 1955. Their survey indicates that certain segments of the food industry are extremely vulnerable to covert attack with BW or CW agents and possibly to RW because of the characteristics of manufacturing processes, the nature of certain foods and their ingredients and the general unawareness of management, technical staff, and labor concerning the potential problem.

VI. Sanitation Problems Associated With Mass Feeding

A. Responsibilities

The emergency welfare services will have the primary responsibility for mass care, emergency housing, feeding and clothing, but these services will look for assistance to the engineering and health services to provide; (1) quality control or food safety at the source, (2) protection of foods in transit and storage, (3) sanitation controls at

mass feeding centers, (4) safety of water supplies, (5) waste problems, (6) insect and rodent control, (7) recruitment, training and supervision of sanitation personnel, (8) assistance in site selection and other problems.

The establishment of quantities, types of food and lines of supply are not the responsibility of the Health Services; however, information relating to these must be made known to health officials in order that emergency sanitation safeguards may be devised. This will involve coordination and planning and the interchange of information between health, supply, transporation and welfare services and others who may be concerned with the food supply. The responsibilities and activities of food and drug and agricultural agencies will, no doubt, be integrated and coordinated with other services in the office of the Civil Defense Director. There are two distinct factors which will have to be dealt with: (1) that of emergency food supply for those who still maintain facilities for food preparation and (2) the problem of mass feeding of populations without such facilities.

The Health Services will be concerned with sanitation problems beginning with:

1. Evacuation or movement of displaced persons in advance of an attack, immediately after an attack warning, and with the spontaneous movement of population.
2. In assembly areas which will be designated areas in the evacuation route where evacuees will be "siphoned off" or moved on to the more permanent reception areas.

3. In reception areas where evacuees may be absorbed into the population temporarily or permanently.

The problem, then, will be to establish feeding facilities with whatever materials and services are available. The emergency feeding should be initiated as soon as possible. Primitive living, sanitation and improvising will be the key to these operations. In the event of a wartime disaster the American National Red Cross will become an integral part of the CD Welfare Services and will not operate independently.

B. Reception Areas

Consideration will have to be given to the safety of greater quantity and varieties of food. First priority must be given to providing a safe supply of water and milk. Preplanning should include the organization and training of sanitation squads drawn from either local or evacuee personnel. However, these squads should be permanent and to be effective will need to have more training. It is anticipated that in reception areas, professionally trained sanitation personnel, resident in the area or brought in from the outside, will have to be made available to assist the welfare services. Their work will include such things as

1. Supervision of milk sanitation.
2. Determination of the safety of food supplies at the source and received from Supply Services.
3. Supervision of food storage conditions.
4. Supervision of sanitation practices associated with mass feeding.
5. Water, waste and insect and rodent problems.

6. Training of food service personnel in proper sanitary practices.

7. Food sanitation at emergency and field hospitals.

C. Restoration of Feeding Facilities

Since restaurants, food bars, cafeterias in churches, schools and industrial plants are potential centers for mass feeding, it will be imperative that these be decontaminated and restored to operation as quickly as possible. Until public utilities are restored, the existing cooking equipment may be converted to use liquid petroleum as a fuel source. If emergency power generators are available, these can be used to provide refrigeration facilities.

Perishable food should be used first, after it has been determined that there is no hazard involved in their consumption. Type of storage, packaging material, monitoring, CW test kits and other information may be used as guidelines in determining the usability of these foods. Two basic foods, namely, bread and milk will be in urgent demand since both are basic foods for adults and childfen. Neither of these can be preserved or easily stored. Immediate attention should be given to the restoration of processing plants to supply these foods. Milk, from animals in fallout areas, which has been cleared thrugh monitoring should be processed as early as possible. In the event that it is not possible to restore plant facilities for processing milk, arrangements should be made through supply and transportation for transporting the raw milk to some plant in an adjacent area which has intact processing facilities. If these

approaches are not feasible whole raw milk should be heated to boiling before consumption.

D. Prevention of Food Contamination and Food Poisoning in Disaster Feeding

One of the major areas of activity of the Health Services will be the protection of food from contamination and the control of food poisoning in mass feeding. Bacteria associated with foodborne outbreaks require moisture and growth temperatures between 50-110°F. Dryness, proper refrigeration, thorough cooking and good sanitation will minimize the occurrence of food poisoning. In mass feeding the primary concern will be the prevention of outbreaks of staphylococcal food poisoning and food infections due primarily to the salmonella group of organisms.

E. Evacuee Families in Private Homes

The introduction of evacuee families into private homes in reception areas offers many distinct advantages. The hazards of foodborne disease will be reduced, the amount of sanitary supervision required will be decreased and the general level of food sanitation of the community would not be materially changed. Factors other than food preparation and service facilities in individual dwellings probably will be the limiting factor in the number of evacuees to be placed in individual homes or absorbed by a community for limited periods of time.

VII. Guide-lines for Pre-Planning

The development of practical and realistic plans and courses of action to solve the manifold food problems which will arise following an attack

will pay dividends. The following guide-lines should be considered in the pre-planning stages.

A. Continuing inventories should be made at the local level of persons who could serve as auxillary sanitarians, laboratory technicians, monitors, etc. The inventories should also include sources of supply of cleaning, sanitizing chemicals and equipment, food equipment such as bottled gas, large cooking kettles, vats, portable field ovens and grills for mass feeding operations and other auxillary equipment.

B. Plans should be developed for providing food for displaced persons, evacuees, casualties, civil defense workers and residents in areas which are not stocked, equipped, staffed or accustomed to large scale feeding operations for indefinite periods of time.

C. Since there will be a rapid depletion of normal food stocks and inability to replace them due to damage to transportation, reserve stocks and processing plants, salvaging and decontaminating food stocks or living "off the land" may become necessary and plans and procedures should be developed accordingly. Plans should be developed with Supply and Welfare Services for requisitioning and payment of foods.

D. Modern sanitation safeguards will be difficult to maintain due to the lack of power, usable fuel supplies, potable water, supplies and equipment. Substitute emergency food sanitation practices should be developed to prevent serious outbreaks of foodborne diseases.

E. Plans should be made with police for protective measures to guard against both sabotage and overt attacks on food supplies and to prevent looting.

F. Provide equipment and train personnel to collect samples, make field tests, and perform laboratory examinations to detect and identify radioactive and infectious or toxic substances.

G. Prepare recommended procedures for handling and disposal of dangerously contaminated food supplies and wastes; recommend feasible emergency methods applicable to both large and small quantities.

H. Develop and distribute information on packaging, transportation, decontamination, and utilization of perishable or contaminated foods, as well as food equipment under disaster conditions.

I. Conduct cooperative surveys with other services of possible assembly and reception areas for sheltering and feeding evacuees in preparation for resolving the sanitation problems which might arise.

J. I have left for special attention in pre-planning, the problem of integration of activities, establishment of liaison and coordination of the efforts of the large numbers and different kinds of governmental agencies, military, social organizations and private enterprises that must work together in a disaster. In one disaster area, the following organizations were actively working:

1. City-County Agencies - Health, Environmental Sanitation, Nursing, Welfare and Housing Departments.

2. State Agencies - Health, Food and Drug, Environmental Sanitation, Nursing, Liquor and related agencies.

3. Federal Health and Welfare Agencies - Public Health Service, Food and Drug, Welfare, Education and several others.

4. Civil Defense Agencies - various city, state, federal and civil defense groups from nearby cities.

5. Military - National Guard, Corps of Engineers, Navy-Marines and Air Force.

6. Social and Private Organizations - Red Cross, Salvation Army, various church groups, labor unions and other agencies. In the event of a wartime disaster the American Red Cross will become an integral part of the CD Welfare Services and integrate their activities accordingly.

In several cases the lack of liaison and coordination of activities resulted in confusion and frustration of the affected population. Pre-planning should be directed to avoid or reduce duplication of effort.

VIII. Summary

It is obvious that the sanitation services of a health unit cannot operate in a vacuum or void. Pre-planning and coordination with other services, such as, welfare, supply, transportation, communication, police and others will be required. It is necessary to more clearly define the areas in which public health workers will be of service in specific assignments relating to food safety and mass feeding.

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